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Performance of citronella (*Cymbopogon spp.*) genotypes for growth, herbage yield and quality under northern dry zone of Karnataka

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Abstract

Nine citronella genotypes were evaluated for growth parameters, herbage yield and essential oil content during 2012-2013 at KRC college of Horticulture, Arabhavi, Karnataka, India. There were two harvests in a year first harvest at 9month after harvesting and second at 3 month after first harvest. There was no significant report with respect to tiller number per plant at both the harvest whereas, maximum tiller per plant (87.13 & 106.40 first and second harvest respectively) was recorded in genotype Mandakini. The significant differences were obtained fresh herbage yield. The result revealed that at both the harvest total maximum yield (73.26 t/ha) was recorded in genotype Assam and total minimum yield (40.95 t/ha) was recorded in Java-2. Essential oil content (FWB) shows significant difference only at first harvest, mean of two years showed highest essential oil content (1.115%) in genotype Java-2, followed by in Bio-13 and Manjari (1.060 & 1.036%) and lowest essential oil content (0.593%) was in genotype Ceylon local.

Keywords: Citronella, essential oil content, herbage yield, FWB (Fresh weight basis)

Introduction

Citronella was first introduced in India in 1959 from Indonesia (Java Island, hence the name Java citronella) Singh and Kaul (1999) [17]. Citronella (*Cymbopogon winterianus* Jowitt) is an aromatic grass belonging to the Poaceae family which gives essential oils upon steam distillation. There are distinctly two types of oil the Ceylon type and the Java type. The Ceylon type oil is obtained from the species *Cymbopogon nardus* Rendle, where as the Java type oil is distilled from the *Cymbopogon winterianus* Jowitt. This is used extensively as a source of perfumery chemicals like citronellal, citronellol and geraniol which finds use in soap, cosmetic and flavoring industry throughout the world. The oil has also got antifungal and antibacterial properties. Citronella leaves contain about 0.8% oil.

India has been a leading producer of essential oils including oil of citronella. However, it is now facing stiff competition from other developing countries, in several commodities both in quality and price. At present, it is found in the states of U.P, M.P, Maharashtra and various parts of India. But areas receiving good and distributed rainfalls throughout the year are suitable for cultivation of citronella. Keeping in view the growing demand of essential oils, the present study was proposed to select a promising variety for the region with an objective of performance of citronella genotypes for growth, herbage and oil yield and quality with this finding selection of superior genotypes for northern dry zone-3 of Karnataka.

Material and Methods

The experiment was carried out in the experimental field at Department of Medicinal and Aromatic crops, Kittur Rani Channamma College of Horticulture, Arabhavi, Belgaum district, Karnataka. Genotypes like T₁: Java-2, T₂: Mandakini, T₃: Manjari, T₄: Assam, T₅: Ceylon local, T₅: CIM Jeeva, T₆: Jalapallavi, T₇: Manjusha, T₈: Bio-13 selected for the experiments. Slips of citronella were planted according to the treatments with the onset of monsoon (July-August) to ensure better establishment. The slips are planted 8-12 cm deep maintaining a spacing of 60 cm X 60 cm and planted during 2012. The crop was harvested nine months after

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planting while ratoon crop was harvested three months after first harvest. While harvesting, tillers were cut at fifteen cm above the ground level. The freshly harvested plants were taken for essential oil distillation. The harvested herbage was distilled in Clevenger's apparatus for extraction of essential oil. Observation on growth and yield parameters were recorded using five randomly selected plants in the net plots. Various observations recorded were as under.

At just before first and second harvesting total number of tillers per clump was counted and the average was worked out. Five plants were selected randomly for recording fresh herb yield and the mean weight was calculated and expressed in grams. Fresh biomass of kg per plot recorded were multiplied with area of hectare (10 000 m²) to obtain yield per hectare, discounting 20 percent area for bund and path. Essential oil recovery percentage was calculated with the formula given here under and expressed in percentage on weight basis.

$$\text{Oil recovery (\%)} = \frac{\text{Weight of oil obtained}}{\text{Weight of grass used}} \times 100$$

Essential oil obtained from different genotypes was analysed by using gas chromatography and percentage of citronella, citronellol and geraniol contents were estimated.

Statistical analysis of the data was done by following the Fisher's method of analysis of variance as given by Panse and Sukhatme (1967) [11]. The level of significance used in 'F' and 't' test was P= 0.05 and critical difference (CD) values were worked out wherever 'F' test was significant.

Results

Number of tillers per clump

The data on Number of tillers per clump of citronella genotypes are presented in table 1. There was no significant difference among citronella genotypes for number of tillers per clump in both the harvests. Maximum mean numbers of tillers per clump were recorded in Mandakini (96.77) followed by Manjusha (80.87) while the minimum were recorded in CIM Jeeva (50.30)

Total Herbage yield (t/ha)

The data on total herbage yield (t/ha) and oil content of citronella genotypes are presented in table 2. There was significant difference among citronella genotypes for total herbage yield per hectare (t/ha). Maximum mean total herbage yield (t/ha). was recorded in Assam (73.26 t/ha) followed by Mandakini (68.80t/ha) while the minimum was recorded in Java 2 (40.95 t/ha)

Essential oil percentage

Significant difference was observed among the genotypes for essential oil percentage on FWB for first harvest only. Maximum mean essential oil percentage was recorded in Manjusha (1.053%) and it was on par with CIM Jeeva (1.046%) compared to the minimum in Ceylon Local (0.593%). Highest Citronellal content was recorded in Manjusha (36.06%) followed by Mandakini (34.37%) compared to lowest in Assam (7.27%). And the Maximum Citronellol content was reported in Ceylon local (34.12%) followed by Manjari (18.84%) and the minimum was reported in CIM Jeeva (7.97%) while no Citronellol content was

recorded in Assam. Geraniol content was highest in Assam (69.34 %) followed by CIM Jeeva (46.88 %) compared to lowest in Mandakini (23.77 %).

Discussion and Summary

Number of tillers

Maximum mean numbers of tillers per clump were recorded in Mandakini (96.77) followed by Manjusha (80.87) while the minimum were recorded in CIM Jeeva (50.30). This variation in number of tillers is attributed to variation in the genetic make-up of the genotypes and interaction with environmental variations which are in line with earlier reports of Singh and Singh (1999) [19] in lemongrass, Lynrah and Chakraborty (2000) [9] and Singh *et al.* (2000) [18] in turmeric, Raina and Gupta (2001) [12] in ginger, Sharma *et al.* in (2005) [14] in *Cymbopogon pendulus*, Ibrahim and Khalidh (2013) [4] in citronella.

Total Herbage yield (t/ha)

Maximum mean total herbage yield (t/ha). was recorded in Assam (73.26 t/ha) followed by Mandakini (68.80t/ha) while the minimum was recorded in Java 2 (40.95 t/ha). Similar variations in fresh weight was also reported by Singh *et al.* (1999) [16] in *Mentha spicata*, Lal *et al.* (2001) [8] in *Cymbopogon flexuosus*, Kumar *et al.* (2008) [6] in lemongrass, Jadav *et al.* (2009) [5] in turmeric,

This variation in total herbage yield per hectare is attributed to the variation in herbage yield per clump and plot and genetic makeup of the genotypes (yield potential) and interaction with environmental variations which are in line with the earlier reports of Lal (2000) [7] in *Veiveria zizaniodes*, Jadav *et al.* (2009) [5] in turmeric, Pandey *et al.* (2010) [10] in turmeric, Ibrahim and Khalid (2013) [4] in Citronella.

Essential oil content (%)

Maximum mean essential oil percentage was recorded in Java 2 (1.115 %) followed by Bio-13 (1.060 %) compared to the minimum in Ceylon Local (0.593 %). Highest Citronellal content was recorded in Manjusha (36.06 %) followed by Mandakini (34.37 %) compared to lowest in Assam (7.27 %). And the Maximum Citronellol content was reported in Ceylon local (34.12 %) followed by Manjari (18.84 %) and the minimum was reported in CIM Jeeva (7.97 %) while no Citronellol content was recorded in Assam. Geraniol content was highest in Assam (69.34 %) followed by CIM Jeeva (46.88 %) compared to lowest in Mandakini (23.77 %).

Table 1. Evaluation of citronella genotypes for number of tillers per clump during 2012-13.

| Genotypes | First harvest | Second harvest | Mean |
|--------------|---------------|----------------|-------|
| Java-2 | 44.00 | 62.26 | 53.13 |
| Mandakini | 87.13 | 106.40 | 96.77 |
| Manjari | 63.73 | 71.53 | 67.63 |
| Assam | 71.73 | 77.60 | 74.67 |
| Ceylon local | 66.33 | 79.06 | 72.70 |
| CIM Jeeva | 49.53 | 51.06 | 50.30 |
| Jalapallavi | 65.46 | 78.40 | 71.93 |
| Manjusha | 71.80 | 89.93 | 80.87 |
| Bio-13 | 63.26 | 76.93 | 70.10 |
| SEm± | 11.25 | 11.60 | |
| CD @ 5% | NS | NS | |

First harvest: 9 Months after planting,
Second harvest: 3 months after first harvest,
NS: Non significant

Table 2: Evaluation of citronella genotypes for herbage yield and oil percentage (FWB) during 2012-13.

| Genotypes | Herbage yield (t/ha) | | | Oil content (%) | | |
|--------------|----------------------|----------------|------------------|-----------------|----------------|--------|
| | First harvest | Second harvest | Total mean yield | First harvest | Second harvest | Mean % |
| Java-2 | 20.65 | 20.30 | 40.95 | 1.046 | 1.183 | 1.115 |
| Mandakini | 40.21 | 28.59 | 68.80 | 0.843 | 0.970 | 0.907 |
| Manjari | 26.95 | 22.61 | 49.56 | 1.036 | 1.036 | 1.036 |
| Assam | 42.93 | 30.33 | 73.26 | 1.036 | 0.983 | 1.010 |
| Ceylon local | 38.14 | 25.82 | 63.96 | 0.556 | 0.630 | 0.593 |
| CIM jeeva | 38.53 | 29.05 | 67.58 | 1.046 | 0.870 | 0.958 |
| Jalapallavi | 29.75 | 25.73 | 55.48 | 1.023 | 0.720 | 0.872 |
| Manjusha | 34.59 | 21.68 | 56.27 | 1.053 | 0.900 | 0.977 |
| Bio-13 | 30.44 | 22.39 | 52.83 | 1.026 | 1.093 | 1.060 |
| SEm± | 3.66 | 1.97 | | 0.036 | 0.122 | - |
| CD @5% | 10.99 | 5.93 | | 0.154 | NS | - |

First harvest: 9 Months after planting,

Second harvest: 3 months after first harvest,

NS: Non significant

Table 3: Evaluation of citronella genotypes for oil quality during 2012-13.

| Genotypes | Citronellal | Citronellol | Geraniol |
|--------------|-------------|-------------|----------|
| Java-2 | 24.79 | 15.56 | 25.45 |
| Mandakini | 34.37 | 16.79 | 23.77 |
| Manjari | 29.57 | 18.84 | 25.83 |
| Assam | 7.27 | Nil | 69.34 |
| Ceylon local | 15.23 | 34.12 | 44.24 |
| CIM Jeeva | 17.74 | 7.97 | 46.88 |
| Jalapallavi | 28.72 | 16.12 | 24.55 |
| Manjusha | 36.06 | 16.00 | 25.03 |
| Bio-13 | 31.66 | 14.07 | 32.32 |

Note: Both harvest's oil mixed according to genotypes and estimated the quality.

This variation in oil content is attributed to the variation in inherent capacity of genotypes, season of harvest, harvesting time and herbage drying period. The present findings are in line with Agarwal and Singh (2000) ^[1] in fennel, Lynrah and Chakrabarthi (2000) ^[9] in turmeric, Lal *et al.* (2001) ^[8] in lemongrass, Datta *et al.* (2001) ^[3] in Ajowan, Shashidhar *et al.* (2000) ^[15] in geranium, Chutia *et al.* (2006) ^[2] in *Cymbopogon winterianus*, Kumar *et al.* (2008) ^[6] in lemongrass, Pandey *et al.* (2010) ^[10] in turmeric and Sarma and Sarma (2005) ^[13] in lemongrass.

Conclusion

Among the nine genotypes of citronella the genotype Assam (73.26 t/ha) recorded highest herbage yield followed by Mandakini (68.80t/ha) and maximum oil content was recorded in Java 2 (1.115%) followed by Bio-13(1.060%). In consideration with herbage yield of Assam and Mandakini we may get maximum estimated oil yield hence these two genotypes may be considered to be better genotypes under the northern dry zone of Karnataka. With respect to quality wise genotypes *viz.*, maximum citronellal yielding genotypes are Manjusha and Mandakini, Citronellol yielding genotypes Ceylon local and Manjari. Whereas, Geraniol yielding best genotypes are Assam and CIM Jeeva.

References

1. Agrawala S, Singh D. Variation in oil yield and its constituents in fennel crosses, Indian Perfumer. 2000; 48(3):283-287.
2. Chutia M, Mahanta JJ, Saikia RC, Baruah AKS, Sarma

TC. Influence of leaf blight disease on yield constituents of Java citronella and in-vitro control of pathogen using essential oils, World Journal of Agricultural Sciences. 2006; 2(3):319-321.

3. Datta S, Chatterjee PS, Medda PS, Chattopadhyay PK. Evaluation of ajowan (*Trychyspermum ammi* L.) introductions for growth, yield and quality, Journal of Spices and Aromatic Crops. 2001; 10(1):37-39.
4. Ibrahim MM, Khalid KA. Phenotypic recurrent selection on herb growth yield of citronella grass (*Cymbopogon nardus*) grown in Egypt, Nusantara bioscience. 2013; 5(2):70-74.
5. Jadav GG, Kankal DS, Ganvir MM. Evaluation of turmeric genotypes in relation to growth, yield and quality parameters, Annuals of Plant Physiology. 2009; 23(2):204-206.
6. Kumar S, Subudhi E, Nayak S, Sahoo S. Differential citral content of 15 lemongrass genotypes and their anti-microbial property, The International Journal of Microbiology. 2008; 6(1):1-6.
7. Lal RK. Genetic variability and association analysis for yield and yield components in indigenous and exotic collections of vetiver (*Vetiveria zizaniodes* (L.) Nash), Journal of Spices and Aromatic Crops. 2000; 9(2):133-136.
8. Lal RK, Sharma JR, Singh N, Naqvi AA, Misra HO. Genetic variability, progeny/clonal selection in lemongrass (*Cymbopogon flexuosus* L), Indian Perfumer, 2001; 45(4):211-215.
9. Lynrah PG, Chakrabarty BK. Performance of some turmeric and its close relatives/genotypes. Journal of Agricultural Sciences Society of North-East India. 2000; 13(1):32-37.
10. Pandey Aditi, Katiyar, Sanjay K. Determination of curcuminoid pigments in turmeric genotypes (*Curcuma domestica* Val), by high-performance liquid chromatography, International Journal of Pharmacy and Pharmaceutical Sciences. 2010; 2(4):125-127.
11. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Publication, New Delhi. 1967, pp. 152-174.
12. Raina RK, Gupta RK. Performance of ginger cultivars in Jammu and Kashmir, Indian Perfumer. 2001; 45(4):223-226.
13. Sarma A, Sarma TC. Morphological characters and yields of oil and citral of certain lemongrass [*Cymbopogon flexuosus* (Steud) Wats] accessions grown under agro-climatic conditions of northeast India, Journal of Essential oil Bearing Plants. 2005; 8(3):250-257.
14. Sharma SN, Baleshwar, Taneja SC. Growth studies on an elemicin containing grass: *Cymbopogon pendulus* (Nees ex. Steud) Wats in Jammu, Indian Perfumer. 2005; 46(2):105-108.
15. Shashidhara KV, Verma RS, Ram P. Evaluation of geranium cultivars (*Pelargonium graveolens*) in Tarai region of Uttaranchal, Indian Perfumer. 2004; 48(3):273-276.
16. Singh J, Sharma R, Meenu S, Srivastava, Chand RC. Genetic variation and heritability studies for some oil yield contributing characters in spearmint (*Mentha spicata* L.), Indian Perfumer. 1999; 43(3):122-125.
17. Singh K, Kaul PN. Yield and quality of Java citronella (*Cymbopogon winterianus* Jowitt) cultivars Java-II and Bio-13 at different harvests under semi-arid tropical

- conditions of Andhra Pradesh, Indian Perfumer. 1999; 43(1):49-53.
18. Singh K, Singh AK, Singh LN. Evaluation of turmeric (*Curcuma longa* L.) germplasm under low hills condition of Himachal Pradesh, Crop Ressearch. 2000; 20(2):324-326.
 19. Singh OP, Singh TP. Genetic variability among some genotype for morphological characters in lemongrass (*Cymbopogan flexuosus* L. Stapf), Indian Perfumer, 1999; 43(1):35-36.